USING INTERACTIVE WHITEBOARDS TO ENHANCE MATHEMATICS TEACHING

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describes how the use of interactive whiteboards not only has the potential to transform teacher pedagogy, but to improve the quality of student learning in mathematics at the whole-school level.

Over the past three years Richardson Primary School has transformed its entire educational program based around the widespread introduction of interactive whiteboards (IWBs) into the school. A review of this initiative states that "Richardson is the first school in the ACT, and probably Australia, where the total school community, the students, staff and parents, has embraced a new approach to the use of ICT, which enhances the holistic education of the students… The Richardson effort represents a near revolution in the use of ICT in schools" (Lee & Boyle, 2003, p. 3).

Early in 2005, Richardson Primary School was awarded one of the Federal Government's National Awards for Quality Schooling for Outstanding School Improvement based on the results achieved using interactive whiteboards. This article describes the new style of pedagogy that was developed to take advantage of this technology with particular reference to the teaching of mathematics.

Interactive whiteboards and "e-teaching"

An interactive whiteboard set-up involves the image generated by a computer being projected onto a touch sensitive screen the size of a conventional whiteboard, where the touch of a pen is the equivalent to a mouse click. It is simply a touch screen computer with a very large screen. However, "the interactive whiteboard is

more than a computer, a projector or a screen — its sum is greater than its parts" (Glover & Miller, 2002). Lee and Boyle (2003, p. 4) state, "after noting how the technology is now being employed at Richardson, the generic term "interactive whiteboard" fails to communicate the immense education capacity of the tool. In reality Richardson is using the technology as a large-scale, digital convergence tool."

The term "e-teaching" has been coined to describe the new pedagogy that is evolving promoted by the use of the IWBs — it involves the use of ICT to enhance the art of teaching.

E-teaching generalisations

E-teaching, as a pedagogical concept, has developed into a number of generalisations which teachers in any context can apply to enhance their classroom practice.

IWBs facilitate digital convergence

Any device or program that can operate on a computer will work with an IWB. In a classroom context this results in a wide range of digital tools converging. Moving between viewing a DVD, to the Internet, making notes in a word document and collecting information from a data logger, is now possible with only a few clicks on the board. It is the teacher's role to manage this convergence of digital technology. Teachers no longer need to wheel TVs and DVDs into and out of the classroom; or organise computer lab bookings; or cycle students through pods of computers in small groups.

In a mathematics teaching context, teachers with an IWB now have a wide range of ICT possibilities available to support their teaching. Teachers can easily move between using virtual graphics calculators, spreadsheet programs, learning objects and mathematics-based software applications. Teachers can use real world examples captured via a digital camera, or use live data sourced in real time from the Internet. The teacher still manages the learning environment, leading the discussion, posing questions, responding to student suggestions, but now they can do so fully supported by a wide range of technology.

Using an IWB can promote intellectual quality through substantive discussions

The content of a traditional whiteboard is not very interactive. Often the content that has been written on the board in order to explore an idea with the class is erased and rewritten in a different form. Reverting to the original content is often not possible. IWBs, either via lessons created with their "flipchart" software or via the use of various forms of learning objects, allows for content with which the class can interact. Such interactions allow the IWB teachers to:

- promote higher order thinking, easily shifting the students' focus from merely remembering the content to gaining a deep understanding of the concepts being taught;
- lead substantive conversations that allow the class to create or negotiate understanding of the subject matter.

Teachers can easily present knowledge as problematic, open to multiple interpretations. Within a mathematics classroom, this means that teachers can lead discussions that probe student understanding of mathematical concepts without being limited by the students' arithmetic abilities. The following examples illustrate this point.

Example 1: Perceptional number skills

In a junior primary setting, the concept of interactive "play" based around interactive content on an IWB is used to assist in the teaching of basic number skills (see Figure 1).

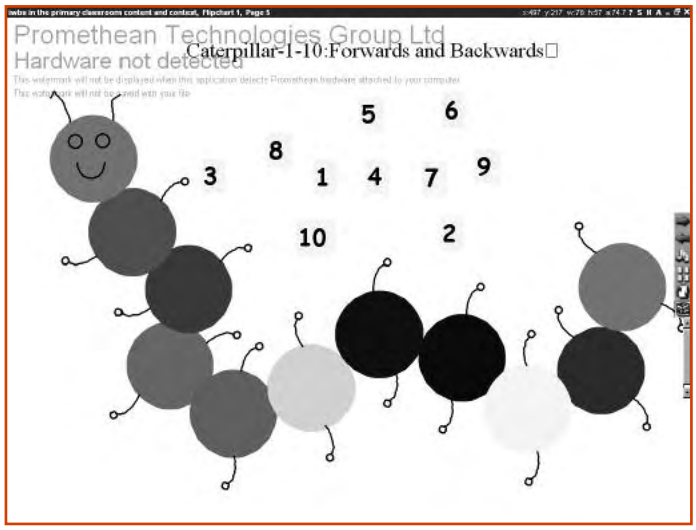

Figure 1. A kindergarten number sequencing activity.

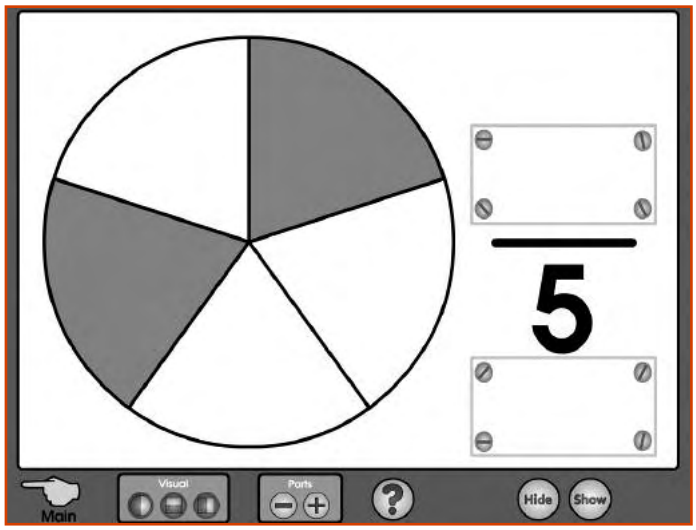

Figure 2. A learning object designed for an IWB.

Figure 3. Digital photograph used in a lesson on symmetry.

In this activity, the teacher leads students to explore perceptional number skills. Students drag the numbers onto the caterpillar's body in the correct order. Teachers can promote intellectual quality and substantive discussions by varying the starting position and counting forwards and backwards from that point. Further, the teacher could assist students in exploring the concept of skip counting.

Example 2: Learning objects

Learning objects, Flash and Shockwave activities and educational CD-ROMS are other examples of IWBs being able to provide content with which students can interact (see Figure 2).

Not only can teachers explore various concepts and present knowledge as problematic, the IWB can be used to model the operation of a learning object to a class.

IWB technology allows teachers to modify the context of the lesson in order to engage students with real, practical or hypothetical problems that connect to their world

Much of the richness of adopting an e-teaching approach is when the class can capture the students' "world" digitally and then use what is captured as part of the lesson. Through this interaction teachers can:

- connect the classes learning to the world beyond the classroom;
- engage the students in learning that is relevant to their everyday life;
- ensure that the curriculum has a real world focus;
- truly negotiate with the class the context of the curriculum within which they will study the defined learning outcomes.

Example 3: Reflection and symmetry in a junior primary context

Rather than completing symmetry tasks for pictures from a book, students identified symmetrical objects in the room. Digital photos were taken of the objects. The photos were then displayed on the IWB and an opaque square was placed over half of the object, along the axis of symmetry. The students estimated and drew the outline of the covered half of the object, drawing on top of the square. The square was then

removed and the students were able to assess the accuracy of their drawings. The most engaging symmetrical objects were students' faces (see Figure 3).

Example 4: Live data

During chance and data lessons, teachers can source real world data from Internet sites that relate to the interests of the students, rather than relying solely on the contexts and data provided within the text books or by rolling dice.

Teachers and students can use IWBs to easily create complex connections between previous learning across all KLA

Taking advantage of a computer's ability to save and retrieve files, teachers using IWBs have the ability to retrieve and display previously taught lessons in a matter of moments. Teachers never again have to say, "Remember when…?" when wanting to make a connection with prior student learning. Equally, students can be empowered to ask, "Is this like when…?" to which the teacher can respond by opening the appropriate lesson, allowing the students to drive the connections themselves.

Example 5: Year 6 teacher-lead scaffolding

When teaching a Year 6 mathematics class about decimals, the teacher became aware that a number of students were having difficulty with the idea of numbers less than 1. The teacher decided to start every decimal lesson by retrieving the fraction lesson that covered the same general concept. The teacher then helped the class to see the similarities between fractions and decimals, allowing students to gain a deeper knowledge of the concept by scaffolding their new learning via pre-existing understandings.

Example 6: Year 4 student-lead scaffolding

During a Health lesson, a Year 4 class was sorting their lunches on a table, collecting the items into food groups. Once the food was sorted the students were required to draw bar graphs of the results.

In the middle of the lesson one student asked, "Is this like when we did bar graphs in maths last term?". The teacher replied with, "Let's find out," and proceeded to retrieve and open the bar graph lesson from last term. The class then had a discussion that enabled them to scaffold and create links between these two lessons.

Applying e-teaching

IWBs, and e-teaching, are still relatively new. There is no lock step guide informing us how to "e-teach". However teachers know how to teach. They know how to present concepts and information, guiding students through enquiry. Within an e-teaching framework, these fundamental qualities and skills of teachers do not change; they are enhanced through the use of IWBs and the convergence of digital technologies that they allow.

References

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